

DeepTech - AI Models in Engineering Solutions

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Abstract

Artificial Intelligence revived in the last decade. The need for progress, the growing processing capacity and the low cost of the Cloud have facilitated the development of new, powerful algorithms. The efficiency of these algorithms in Big Data processing, Deep Learning and Convolutional Networks is transforming the way we work and is opening new horizons. Thanks to them, we can now analyse data and obtain unimaginable solutions to today's problems. Nevertheless, our success is not entirely based on algorithms, it also comes from our ability to follow our "gut" when choosing the best combination of algorithms for an intelligent artefact. It's about approaching engineering with a lot of knowledge and tact. This involves the use of both connectionist and symbolic systems, and of having a full understanding of the algorithms used. Moreover, to address today's problems we must work with both historical and real-time data. We must fully comprehend the problem, its time evolution, as well as the relevance and implications of each piece of data, etc. It is also important to consider development time, costs and the ability to create systems that will interact with their environment, will connect with the objects that surround them and will manage the data they obtain in a reliable manner.

In this keynote, the evolution of intelligent computer systems will be examined. The need for human capital will be emphasised, as well as the need to follow one's "gut instinct" in problem-solving. We will look at the benefits of combining information and knowledge to solve complex problems and will examine how knowledge engineering facilitates the integration of different algorithms. Furthermore, we will analyse the importance of

complementary technologies such as IoT and Blockchain in the development of intelligent systems. It will be shown how tools like "Deep Intelligence" make it possible to create computer systems efficiently and effectively. "Smart" infrastructures need to incorporate all added-value resources so they can offer useful services to the society, while reducing costs, ensuring reliability and improving the quality of life of the citizens. The combination of AI with IoT and with blockchain offers a world of possibilities and opportunities.

The use of edge platforms or fog computing helps increase efficiency, reduce network latency, improve security and bring intelligence to the edge of the network; close to the sensors, users and to the medium used.

This keynote will present success stories regarding biotechnology, smart cities, industry 4.0, the economy, and others. All these fields require the development of interactive, reliable and secure systems which we are capable of building thanks to current advances. Several use cases of intelligent systems will be presented and it will be analysed how the different processes have been optimized by means of tools that facilitate decision-making.

The blockchain system, appeared in 2009 together with the virtual currency bitcoin, is a record of digital transactions based on a huge database in which all financial operations carried out with electronic currency are registered. The Blockchain (or chain of blocks) is a shared database that works as a book for the record of purchase-sale operations or any other transaction. It is the technological base of the operation of bitcoin, for example. It consists of a set of notes that are in a shared online database in which operations, quantities, dates and participants are registered by means of codes. By using cryptographic keys and being distributed by many computers (people), it presents security advantages against manipulation and fraud. A modification in one of the copies would be useless, but the change must be made in all the copies because the database is open and public.

All the blocks that make up the chain have a hash (numerical password) of the previous block, the blocks are arranged in the chain in chronological order thanks to that hash, all the blocks are referenced by the block that created them, so only the Blocks containing a valid hash are

entered in the chain and replicated to all nodes. Thanks to this system it is practically impossible to modify a block that has been in the chain for a certain time. The "mining" nodes are responsible for creating the blocks that make up the chain, adding to each of them the corresponding hash and all the new transactions that have been introduced into the network. In this way we can say that the blockchain allows us to keep a fully transparent public "accounting" of all network transactions, with almost no possibility of fraud, congestion or loss of data and fully traceable.

AIoT is a term, also known as intelligence of things, which refers to the new wave of the future of technology that combines two major platforms, very present in today's market: Artificial Intelligence (AI) and the Internet of things (IoT). The IoT is a concept that refers to a digital interconnection of everyday objects with the Internet. It has its theoretical basis in the addition of sensors and connectivity to any object and, eventually, it can also have its own processing capabilities, although this is not strictly necessary to enter the definition of IoT. On the other hand, Artificial Intelligence is an algorithm nurtured by statistical models that allow "learning" through feedback. What is intended to do with this union is to try to add a cognitive and executive layer to the current functionality of objects in order to provide them with autonomy to analyze situations and make decisions. As IoT devices will generate large amounts of data, Artificial Intelligence is going to be functionally necessary to deal with these huge volumes if we are to have any chance of making sense of the data. This whole process will be called connected intelligence. To take this step forward and definitively enter the era of Intelligence of Things, we will need to enable to a greater or lesser part these cognitive and executive capacities towards objects. To do this, we are going to talk more and more about the concept of Edge Computing (or "edge computing"), which is nothing more than the ability to process data, analyze situations, evaluate possible scenarios and make decisions from the object itself and not from a server hundreds or thousands of miles away. This keynote will present success stories regarding biotechnology, smart cities, industry 4.0, the economy, and others. All these fields require the development of interactive, reliable and secure systems which we are capable of building thanks to current advances. Several

use cases of intelligent systems will be presented and it will be analysed how the different processes have been optimized by means of tools that facilitate decision-making.

Industrial Internet of Things A fundamental aspect involved in applications within Industry 4.0 is the Internet of Things (IoT), which emerges as a new milestone in the Internet for that billions of objects are equipped with various types of sensors, connected to the Internet through heterogeneous networks. However, the information that is generally provided to users is based on one-dimensional space, and corresponds mainly to the location where the sensor is located. They will be presented will have related to the different open and interoperable layers that the different IoT architecture schemes, including FIWARE, ETSI or GS1 in the IoT mediation and management layers, as well as standards such as MQTT, LightWeight M2M and OneM2M in the IoT services layer. IIoT and Edge Computing for monitoring and detecting patterns in Industry 4.0 Smart cities, precision agriculture, home automation, telemetry and smart meters, as well as the monitoring of remote industrial facilities, are just some examples of telemonitoring of the applications that the more than 26 billion connected IoT devices in the world in 2019 according to IHS Markit. Such quantity of devices generates a huge volume of data that is transferred to infrastructures in the Cloud, implying computation and storage costs in it. In this sense, there is still much to exploit the benefits of Edge Computing to reduce the necessary traffic to the Cloud and maintain operability during potential communication outages with the cloud. Machine Learning and AI Algorithms for Classification Machine Learning techniques include a wide variety of algorithms, among which we can highlight in general: neural networks (deep Neural Networks within the so-called Deep Learning), perceptrons, SVM kernels (Support Vector Machine), decision trees, Case Based Reasoning (CBR), or clustering techniques. Thanks to this type of technique, it is possible to classify a set of input data into a series of output categories. These techniques include the well-known k-means or advanced spectral clustering [1-310].

CV

Juan Manuel Corchado (born May 15, 1971 in Salamanca, Spain). He is Full Professor with Chair at the University of Salamanca. He was Vice President for Research and Technology Transfer from December 2013 to December 2017 and the Director of the Science Park of the University of Salamanca, Director of the Doctoral School of the University until December 2017 and also, he has been elected twice as the Dean of the Faculty of Science at the University of Salamanca. In addition to a PhD in Computer Sciences from the University of Salamanca, he holds a PhD in Artificial Intelligence from the University of the West of Scotland. Juan Manuel Corchado is Visiting Professor at Osaka Institute of Technology since January 2015 and Visiting Professor at the Universiti Malaysia Kelantan.

Corchado is the Director of the European IoT Digital Innovation Hub and of the BISITE (Bioinformatics, Intelligent Systems and Educational Technology) Research Group, which he created in the year 2000, President of the AIR Institute, Academic Director of the Institute of Digital Art and Animation of the University of Salamanca and has been President of the IEEE Systems, Man and Cybernetics Spanish Chapter. He also oversees the Master's programs in Digital Animation, Security, Blockchain, IoT, Mobile Technology, Information Systems Management and Agile Project Management at the University of Salamanca.

Corchado has supervised more than 25 PhD theses, is author of over 800 research peer review papers and books, has chaired the scientific committee of more than 30 international conferences, and is also Editor-in-Chief of Specialized Journals like ADCAIJ (Advances in Distributed Computing and Artificial Intelligence Journal) and OJCST (Oriental Journal of Computer Science and Technology).

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